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Also solved by B. F. Yanney, L. C. Mathewson, and the Proposer.

Note. No solutions have been received for problems proposed in 1913 under this heading, except for 188 and 190. Solutions for the remaining ones are desired. Please remember that 191 to 196 are incorrectly numbered 187–192. See page 258 of the October, 1913, issue.

MISCELLANEOUS QUESTIONS.

Edited by R. D. Carmichael.

The new department of "Miscellaneous Questions" has met with a pleasing reception among our readers; and we desire to express our appreciation of the interest which has already been manifested through the contributions of questions and replies. We hope to have the coöperation of a considerable number of persons in realizing the double purpose announced in the issue of November, 1913. One of our correspondents, who is a physicist, has written concerning one of these purposes; and we desire to call attention to his remarks in order that we may invite our readers to assist us in realizing the advantages which are mentioned:

"I believe that your department of miscellaneous questions could render valuable service in bringing together the mathematicians and the physicists. Generally the physicist does not know his mathematics sufficiently well to enable him to handle original problems, while the mathematician cannot keep in touch with the developments in physics; but it ought to be possible to work out a plan so that the combined skill of the mathematician and the physicist could be utilized in the solution of the many physical problems. It strikes me that your department of miscellaneous questions could be developed so as to cover this field, and I believe that it would be very useful."

In this issue we have the first replies to our questions. This is the time to say that a question is not disposed of because we have published some answers to it. We wish to have it understood clearly that, although it is desirable to have early replies to our questions, it is yet never too late to send in other replies. In fact, we believe that it will often happen that one set of answers to a given question will provoke others; and that the same question may often be discussed through several issues. Question 2 is one which is probably of this kind.

Again, we shall often print partial answers to a given question in order to call forth a further or more complete answer. This we are doing in the present issue in the case of question 1.

QUESTION.

5. In what ways may mathematics contribute most to the culture of the individual? What is being done and what may be done to advantage in the matter of developing courses in culture mathematics?

REPLIES.

1. In connection with the investigation of a problem in physics Mr. Louis Cohen, Washington, D. C., requires to have expressed in the form of a Fourier's series

$$y = \Sigma A_n \cos nt + \Sigma \beta_n \sin nt \tag{1}$$

the general solution of the differential equation

$$\frac{dy}{dt} + (\alpha + \beta \cos t)y = \rho \cos t, \tag{2}$$

where α, β and ρ are constants. Is the solution of this problem contained directly in matter which has already been published? If not, how may one proceed to the determination of the constants A_n and B_n so that (1) shall be the general solution of (2)?

I. Remarks by C. N. Haskins, Lebanon, N. H.

With reference to the equation in the problem it may be noted that since the general solution is

$$y = \rho(ce^{-(\alpha t+\beta \sin t)} + e^{-(\alpha t+\beta \sin t)} \int e^{\alpha t+\beta \sin t} \cos t dt,$$

a solution in the form

$$y = \rho(ce^{-\alpha t}F_1(t) + F_1(t)F_2(t)),$$

where $F_1(t)$ and $F_2(t)$ are Fourier's series, can be found by noting that the coefficients of the Fourier expansion of $e^{\beta \sin t}$ are simple functions of the quantities $I_n(\beta)$, where

$$I_n(\beta) = i^{-n}J_n(i\beta),$$

the Bessel function of order n with pure imaginary argument. Having found the coefficients in $F_1(t)$ and $F_2(t)$ those in their product may be computed, so that the solution takes the form

$$y = \rho(ce^{-\alpha t}F_1(t) + F(t)),$$

where $F(t)$ and $F_1(t)$ are Fourier's series. This is not the form of solution demanded; but it would appear to be a preferable form for some purposes at least, since the strictly periodic terms are separated from those which are affected with the damping factor $e^{-\alpha t}$ and the arbitrary constant c.

II. Note by the Editor.—The above remarks suggest a means of finding a solution in a form different from that required in the problem. It is given because it seems to be of interest in itself and because further it may be of value in securing the desired solution. We shall be glad to have further communications relative to this problem. Concerning its importance note the following remark by the proposer: "The problem itself is of great importance; a satisfactory solution of this differential equation would lead to a very interesting development of a group of problems in electrical theory."

2. It is clear, on the most casual observation, that the average college curriculum in mathematics is unbalanced in two respects: (1) algebra predominates over geometry, (2) analytic geometry predominates over our synthetic geometry. This reacts in two undesirable ways: (1) to deprive the college student of a rich and interesting field of study, (2) to give a very one-sided training for prospective teachers of high school mathematics. What can be done to remedy this situation?

I. Remarks by D. N. Lehmer, University of California.

In reading the paper on "Synthetic Projective Geometry" in the November issue of the Monthly, I was a little surprised to see that after all our teaching of that subject in the University of California for at least ten years, with some little research and very great enjoyment on the part of the students, the work should not have attracted enough notice to be mentioned. We are giving the course to sophomores and even to some freshmen, with and without the calculus, and we think that it has been the salvation of many students. There comes a time in the life of every mathematical student when the continual grind of analysis becomes unbearable. I have felt it myself, and I do not doubt that others have felt it also. Then is the time to give him something really beautiful for a relief. The constant insistence on rigorous proofs and existence theorems does not encourage one in the delusion that the subject of mathematics is one long vista of eternal joy.

I cannot find any particular reason why the calculus should be considered as a "prerequisite" for the subject. If it is supposed that no one can appreciate it without several years of analysis to prepare the way, it only indicates that it has never been tried. I have had freshmen do fine work in the subject and be so filled with the beauty of it that they immediately changed all their plans and went in for mathematics. I have a course in "culture mathematics" and a taste of this study often proves to be the salvation of the course. I think I do not exaggerate when I say that it is the most popular and most thoroughly enjoyed of all the courses given here in mathematics. It is required of all candidates for teachers' certificates in mathematics.

It is gratifying to know that others are waking up to the possibilities of this subject. If, as Mr. Bussey says in his article, the subject is out of the highways of workers in research (and I am not ready to grant that) there is no question of its real value as a relief from the dreary grind of analysis.

II. REMARKS BY C. E. STROMQUIST, University of Wyoming.

I have just read the article in the November number of the MONTHLY on "Synthetic Projective Geometry as an Undergraduate Study." I was very much interested, as I have a class in projective geometry this semester and many of the questions taken up regarding a first course in projective geometry have presented themselves to me. I am not certain whether I agree that a student who is preparing to do graduate work in mathematics "can afford to wait and take projective geometry when he is a graduate." My suggestion would be that he take an introductory course while an undergraduate student in order to be prepared for a more advanced graduate course. But our problem out here in Wyoming is not so much to arrange courses for prospective graduate students as to solve the problem of how to best fit those (undergraduate) students in our mathematical courses who are preparing to teach mathematics in our high schoools. I heartily agree with what Professor Bussey has to say regarding these students and think that his paper is a very timely one.

For a text-book I am using Hatton's "Principles of Projective Geometry" (published by the Cambridge University Press, 1913). In my judgment it is a very satisfactory text for a first course. It covers more ground than one could expect to cover in a half-year course, with three hours a week; but this is not such a serious objection. It contains several sets of problems. There are about 250 of these problems, not including several easier problems placed in the body of the ext.

III. Remarks by T. G. Rodgers, Normal School of New Mexico.

On graduating from a state university several years ago I began teaching high school mathematics. I found that aside from the larger vision gained in undergraduate study in the university I was no better prepared to teach geometry than on completing the high school course. Observation soon convinced me that others too were teaching merely the geometry which they had learned in the high school. An introduction to projective geometry in subsequent graduate work was of benefit but left me still feeling inadequately prepared to teach elementary geometry as a living subject.

My continued search for better methods was finally rewarded through my forming an acquaintance with the works of Rouche and Comberousse, Henrici and Treutlein, and Hadamard. The study of these works has enriched my teaching of geometry to such an extent that I look back with regret to the years in which I tried to teach the subject with only such preparation as the colleges give and with the feeling that college curricula are badly balanced in respect to their preparation of teachers for high school mathematics.

It appears to me that at least one year's work should be given to the study of synthetic geometry, the first half being a lecture course based on works like those mentioned above (especially Hadamard) and the second half being the kind of course in projective geometry outlined by Professor Bussey in the November issue of the Monthly.

NOTES AND NEWS.

Under the direction of Florian Cajori.

Please note that the date on your address label for this issue is changed if your renewal subscription was received before January 10, 1914.

The October number of the *Monist* contains an article by Professor Bertrand Russell on "The Philosophical Importance of Mathematical Logic."

The November number of *School Science and Mathematics* contains an article entitled "A Thread of Mathematical History and Some Lessons," by Professor R. D. Carmichael, of the University of Indiana.

The November number of the *School Review* contains an interesting paper entitled "The Cumulative Examination in Mathematics," by Mr. H. E. Webb, of Newark, N. J. He suggests a series of cumulative examinations extending over the three or four years of high school mathematics.

Dr. Heinrich Burkhardt's "Theory of Functions of a Complex Variable" has been translated into English by Professor S. E. Rasor of the Ohio State University, and published by D. C. Heath & Company.

Spon & Chamberlain have published a book on "The Gyroscope: its Theory and Practise" by Dr. F. J. B. Cordeiro, of the U. S. Navy. While abroad the author made a special study of the gyroscopic compass.